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(54) Title of the Invention: **Multilayer annular sealing material**

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(57) Claims

Multilayer annular sealing material comprising at least one layer of a first annular layer of polytetrafluoroethylene and at least one layer of a second annular layer of porous polytetrafluoroethylene, wherein adjacent layers are fixed/unified at their outside peripheral faces and inside peripheral faces.

Detailed Description of the Invention

The invention relates to sealing material of annular configuration comprising one or more polytetrafluoroethylene (PTFE) layers and one or more porous PTFE layers.

Single-layer products of PTFE in ring shape are widely used as sealing components in various products, for example, sealing materials for couplings in fluid transport lines.

The single-layer products undergo relatively large deformation due to stress at normal temperature, and moreover have poor recovery from deformation, and thus lack poor "conformance" with fluid transport lines when installed in a coupling in a fluid transport line and fastened with bolts or the like, and consequently have inadequate sealing action, so that leakage may occur when fluids are transported through the fluid transport line. Particularly when a fluid is flammable, leaking of the fluid poses the risk of extremely severe results, and accordingly there is a need for sealing materials free of this problem.

The invention relates to a multilayer annular sealing material that solves this problem, and that comprises at least one layer of a first annular layer of polytetrafluoroethylene and at least one layer of a second annular layer of porous polytetrafluoroethylene, wherein adjacent layers are fixed/unified at their outside peripheral faces and inside peripheral faces.

The first annular layer herein is an annular layer composed of PTFE, and during sealing it undergoes an appropriate degree of deformation due to stress. If the multilayer annular sealing material will be subjected to considerable stress, the first annular layer may additionally incorporate a filler such as molybdenum, carbon, graphite, glass fiber, bronze etc. to make it harder. The amount of filler will depend on the type of filler, the degree of stress to which the sealing material will be subjected, and other factors, but is typically about 5 to 70 wt%.

The second annular layer is composed of porous PTFE containing a multitude of pores, and is endowed with an appropriate degree of deformation due to stress, as well as high deformation recovery force. Porosity and pore size may be selected with reference to the extent of force to which the multilayer annular sealing material will be subjected

during service; typically values are porosity of about 30 to 80% and pore size of about 0.5 to 200 .

The second annular layer may be produced, for example, by sintering PTFE powder and then shaping the sintered PTFE powder into a ring configuration at relatively low pressure (molding pressure of about 100 $^{mm}/_{cm}^{2}$ or lower) using a hot coining process.

The first and second annular layers herein may be sintered or unsintered, although sintered materials are preferred for their shape recovery from stress-induced deformation.

One or more of the first and second annular layers herein may be stacked in tubular configuration and adjacent layers fused or adhered together at their outside peripheral faces and inside peripheral faces to effect fixation/unification thereof.

In the multilayer annular sealing material herein the first annular layer(s) and second annular layer(s) are exposed at both edges (see Figs, 4, 6), so when arranged in a seal portion such as a coupling in a fluid transport line and fastened with bolts or the like, the two annular layers undergo deformation due to the stress of tightening, and the second annular layer has high deformation recovery force owing to its porosity, whereby once deformed, owing to its shape recovery it rapidly conforms to mated parts, providing excellent sealing action and preventing any leakage of fluid.

Using the second annular layer herein as the outermost layer is preferred, as sealing action is markedly improved.

A fuller understanding of the invention is provided through the following description of examples with reference to the drawings. In Figs. 1 and 2, 1 denotes a first annular layer of PTFE, the first annular layer 1 having second annular layers 2 of porous PTFE juxtaposed to its outside peripheral face and inside peripheral face, and fixed/unified therewith by fusion.

Figs. 3 and 4 depict another example; in this example, first annular layers 1 are juxtaposed to the outside peripheral face and inside peripheral face of a second annular layer 2 and fixed/unified therewith.

Figs. 5 and 6 depict yet another example wherein an elliptical second annular layer 2 is juxtaposed to the outside peripheral face of an elliptical first annular layer 1 and fixed/unified therewith.

The preceding examples are all examples of double layer or triple layer construction, but multilayer constructions of four or more layers are possible herein.

By virtue of the arrangement described hereinabove the invention now provides advantages such as excellent sealing action, simple structure and ease of manufacture.

Brief Description of the Drawings

Figs. 1, 3 and 5 are front views showing examples of multilayer annular sealing materials herein; Fig. 2 is a perspective view, split in half and viewed on the diagonal' and Figs. 4 and 6 are side views corresponding to Figs. 3 and 5.

Fig. 1

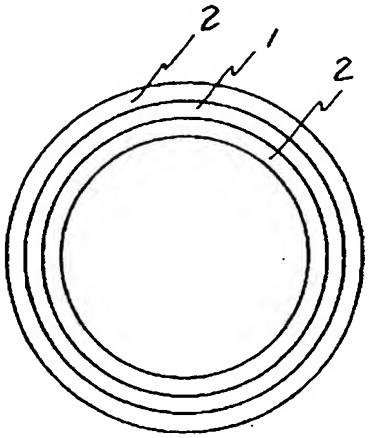

Fig. 2

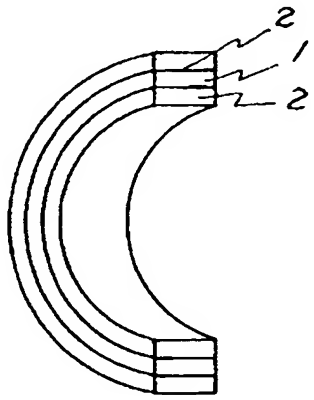

Fig. 3

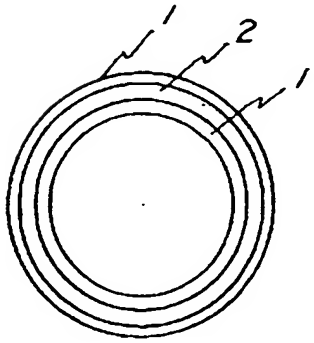

Fig. 4

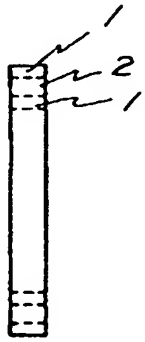

Fig. 5

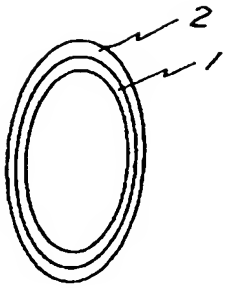

Fig. 6